

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.2 SUBMITTALS

- A. Product Data: For each manufactured material and product indicated.
- B. Design Mixes: For each concrete mix indicated.
- C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.
- D. Material test reports.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
- B. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
 - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - 2. Formwork and form accessories.
 - 3. Steel reinforcement and supports.
 - 4. Concrete mixtures.
 - 5. Handling, placing, and constructing concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: Furnish formwork and form accessories according to ACI 301.
- B. Steel Reinforcement:
 - 1. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

2. Plain-Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
3. Deformed-Steel Welded Wire Fabric: ASTM A497, flat sheet.

C. Concrete Materials:

1. Portland Cement: ASTM C150, Type II.
2. Normal-Weight Aggregate: ASTM C33, uniformly graded, not exceeding $\frac{3}{4}$ inch nominal size.
3. Water: Complying with ASTM C94.

D. Admixtures:

1. Air-Entraining Admixture: ASTM C260.

E. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

F. Curing Materials:

1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
2. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
3. Water: Potable.

2.2 CONCRETE MIXES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
 1. Compressive Strength (28 Days): 4000 psi.
 2. Slump: 3 inches.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6.0 percent within a tolerance of plus 1.0 or minus 1.5 percent.

2.3 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with ASTM C 94.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

- B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- C. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
 - 2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

- A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

- B. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.4 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

3.5 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Cure formed and unformed concrete for at least seven days as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist with water saturated and kept continuously wet.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement at no additional cost to the Government. Tests will be performed according to ACI 301.
 - 1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

END OF SECTION